3-Consider the mass–spring–damper system of Figure 1, which may be subject to two inpforces u1(t) and u2(t). Show that the displacements x1(t) and x2(t) of the two masses are given by

$K_1 = 1\ k_2 = 4, m_2 = 4, B = 2$
$u_1(t) = \sin t, u_2(t) = u \sin t$
$x_1 = x_2 = \dot{x}_1 = 0, x_2 = 2, t = 0$
$M_1 \frac{d^2x_1}{dt^2} + k_1(x_1) + B_1(\dot{x}_1 - \dot{x}_2) = u_1(t)$
$M_1 \frac{d^2x_1}{dt^2} = -k_1(x_1) + B_1(\dot{x}_2 - \dot{x}_1) + u_1(t)$
$M_2 \frac{d^2x_2}{dt^2} = +k_2x_2 + B_1(\dot{x}_2 - \dot{x}_1) + u_2(t)$
$M_2 \frac{d^2x_2}{dt^2} = -k_1x_1 - B_1(\dot{x}_2 - \dot{x}_1) + u_2(t)$
$\frac{d^2x_1}{dt^2} = -k_1x_1 + 2(\dot{x}_2 - \dot{x}_1) + \sin t$
$u\frac{d^2x_1}{dt^2} = -u\ x_2 - 2(\dot{x}_2 - \dot{x}_1) + u \sin t$
$\frac{d^2x_1}{dt} = x_1t + 2(x_2 - x_1) - \cos t + c$
$x_2 = \frac{dx_2}{dt} \int \frac{dx_2}{dt} = x_2$
$x_1 = -\frac{x_1t^2}{2} + 2(x_2 - x_1) - \sin t + c_1 + c_2$
$t = 0, \quad x_1 = x_2 = 0$
$c_2 = 0,$
$t = 0, \quad x_1 = 0,\ x_2 = 2, x_1 = x_2 = 0$

$0 = 0 + 2(0 - 0) - 1 + c_1 c_1 = 1$

$x_1(t) = -x_1\frac{(t)t^2}{2} + 2x_2(t)t - 2x,(t)t - \sin t + 1(t)$
$x_1(t) = \frac{t^2}{2} + 2(x_1(t)t + x(t) + 2x,(t)t - \sin t + (t)$
$x_1(t) = (\frac{t^2}{2} + 2t + 1)2x_2(t)t - \sin t + (t)$
$u\frac{d^2x_2}{dt} = \Sigma - ux_2t - 2(x_2 - x_1) - u\cos + c_1$
$u_1x_2 = -u\frac{d^2x_2}{dt} = \Sigma - ux_2t - 2(x_2 - x_1) - u\cos + c_1$
$u_1x_2 = -ux_2\frac{t^2}{2} = -2(x_2 - x_1)t - u\sin + c_1t + c_2$
then $t = 0, x_1 = x_2 = 0$
$\Rightarrow c_2 = 0$
$t = 0\ \ x_1 = x_2 = 0,\ x_1 = 0, x_2 = 2$
$u(x) = 0 - 0 - 4 - c_1$
$c_1 = 8 + 4$
$c_1 = 12$
$4(x_2(t) = -2(x_2(t))t^2 - 2(x_2(t)t + 2x(t) - 4\sin t + 12t$
$2x_2(t)t^2 + 2x_2(t)t + (x_2(t)) = 2x_1(t)\ \ t - 4\sin + 12t$

$\frac{2x_1(t)\ \ t-4\sin+12t}{2(t^2 4t+2)} : -$

$$x_1(t)(\tfrac{t^2}{2} + 2t + 1) = (\tfrac{2x_1(t) \quad t-4\sin+12t}{(t^2+t+2)}) - \sin t + t$$
$$x_1(t)(\tfrac{t^2}{2} + 2t + 1) = \tfrac{2x_1(t) \quad t-4\sin+12t}{(t^2+t+2} - \sin t + t$$
$$x_1(t)(\tfrac{t^2}{2} + 2t + 1) = -\tfrac{2x_1(t) \quad t-4\sin+12t}{(t^2+2t+2)} - \sin + t$$
$$x_1(t)(\tfrac{t^2}{2} + 2t + 1) = -\tfrac{2x_1(t) \quad t}{(t^2+2t+2)} = \tfrac{-u\sin t+12t-(\sin t-t)(t^2+t+t)}{(t^2+2t+2)}$$
$$x_1(t) = \tfrac{-u\sin t+12t-(\sin t-t)(t^2+t+2)}{((\frac{t^2}{2}+2t+1)((t^2+t+2)-2t)} \Longrightarrow\Longrightarrow x_1(t) = 2\tfrac{-u\sin t+12t-(\sin t-t)(t^2+t+2)}{((\frac{t^2}{2}+2t+1)(t^2+t+2)-2t)} t - u\sin t + 12t =$$